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(54) **GASKET**

(71) Applicant: **FREUDENBERG SEALING TECHNOLOGIES S.A.S. DI EXTERNA ITALIA S.R.L.U**, Pinerolo (IT)

(72) Inventors: **Pasquale Angiulli**, Pinerolo (IT); **Luca Breusa**, Pinerolo (IT); **Francesco Vignolo**, Pinerolo (IT); **Stefano Miletto**, Pinerolo (IT); **Maurizio Buro**, Pinerolo (IT)

(73) Assignee: **FREUDENBERG SEALING TECHNOLOGIES S.A.S. DI EXTERNA ITALIA S.R.L.U.** (IT)

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(Continued)

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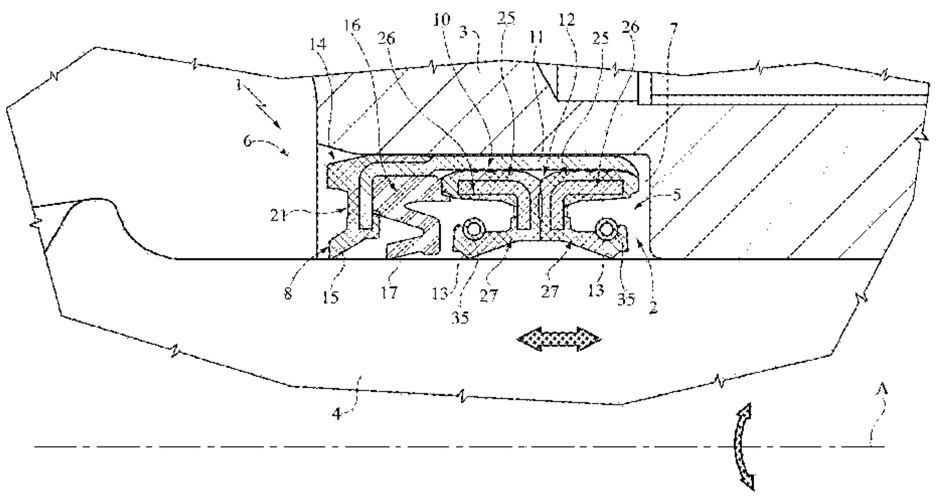
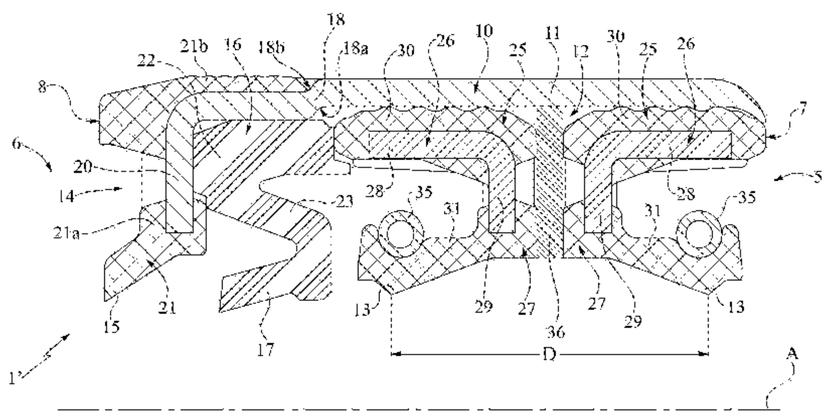
Primary Examiner — Nicholas L Foster
(74) *Attorney, Agent, or Firm* — The Belles Group, P.C.

(57) **ABSTRACT**

A gasket for sealing a compartment between a fixed and a roto-translatory member. The gasket has a metal support ring adapted to be connected to the fixed member; first sealing means in a position adjacent to a first ambient containing lubricant and defining two first annular sealing lips axially spaced to cooperate with the roto-translatory member and to counter the passage of lubricant/external contaminants between the first ambient and a second ambient connected with the outside; and second sealing means axially interposed between the first sealing means and the second ambient and defining a second sealing lip axially spaced from the first annular sealing lips and adapted to cooperate with the roto-translatory member to counter the passage of external contaminants towards the first sealing lips; the first sealing means comprise two first distinct sealing rings, axially arranged side by side and respectively carrying a relative first sealing lip.

11 Claims, 4 Drawing Sheets





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F16J 15/3252 (2016.01)
F16J 15/3268 (2016.01)
F16J 15/3284 (2016.01)

(58) **Field of Classification Search**
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See application file for complete search history.

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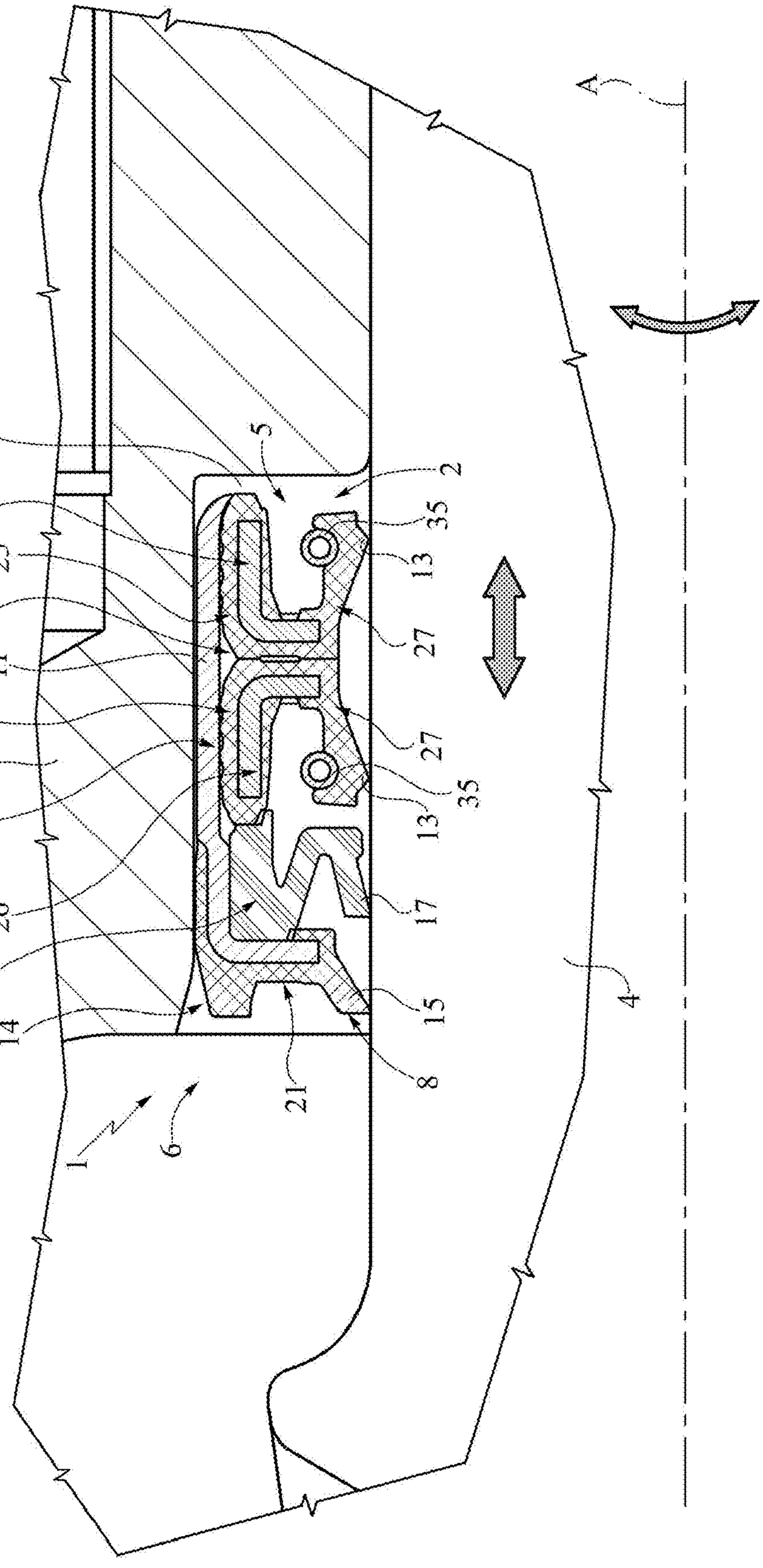
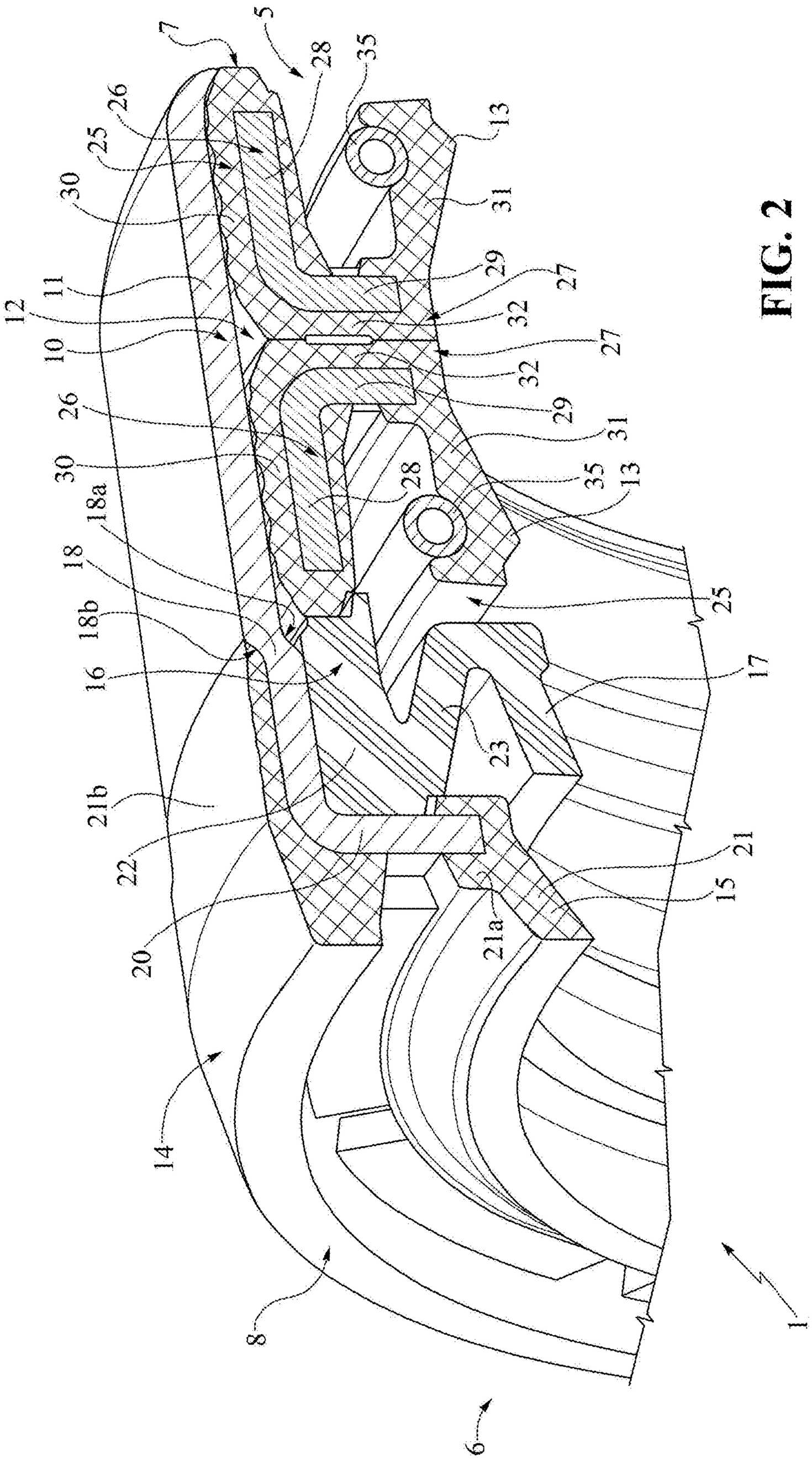


FIG. 1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18a
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18b
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17
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21b
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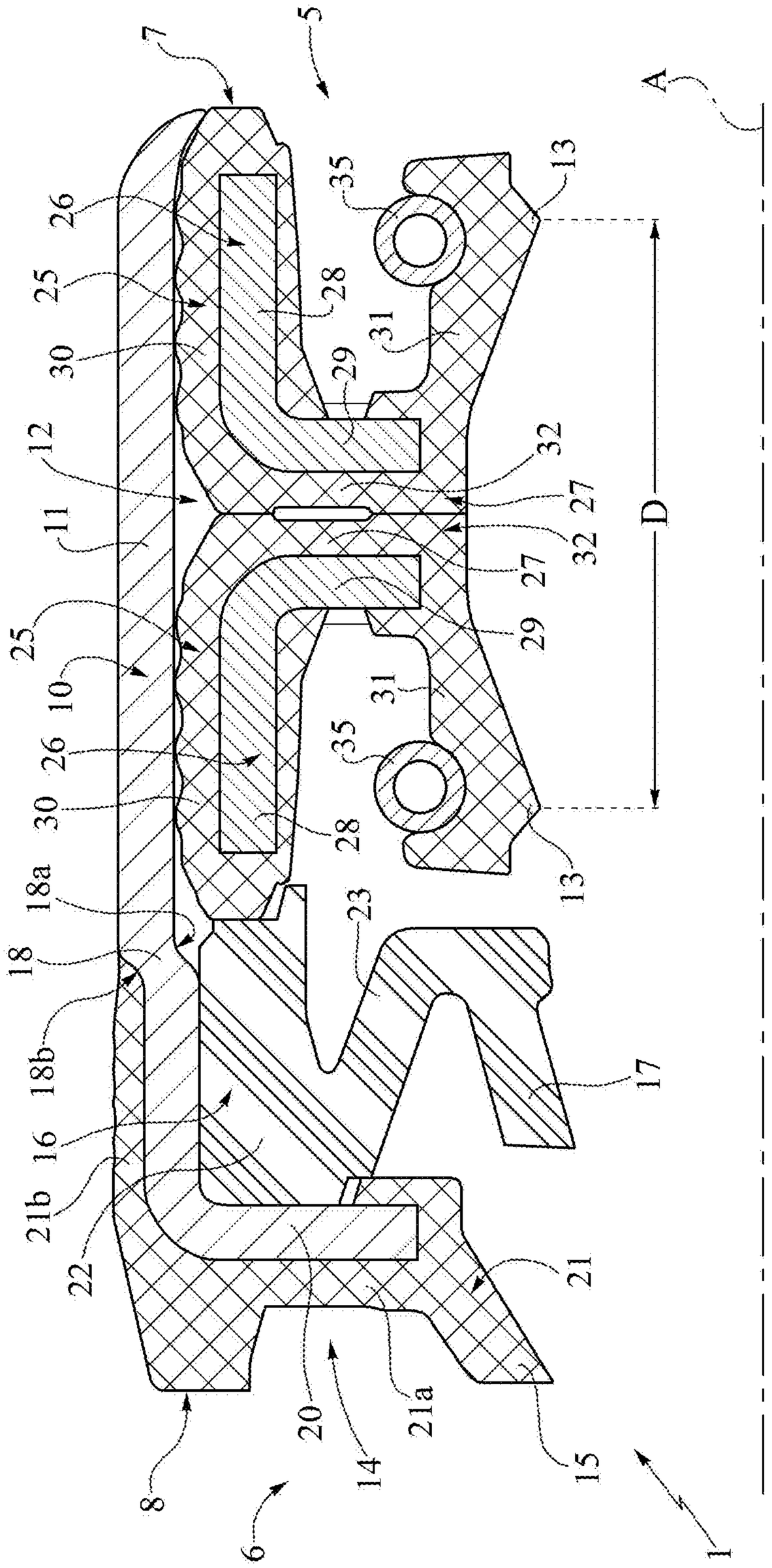
1

FIG. 2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18a
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21b
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21a
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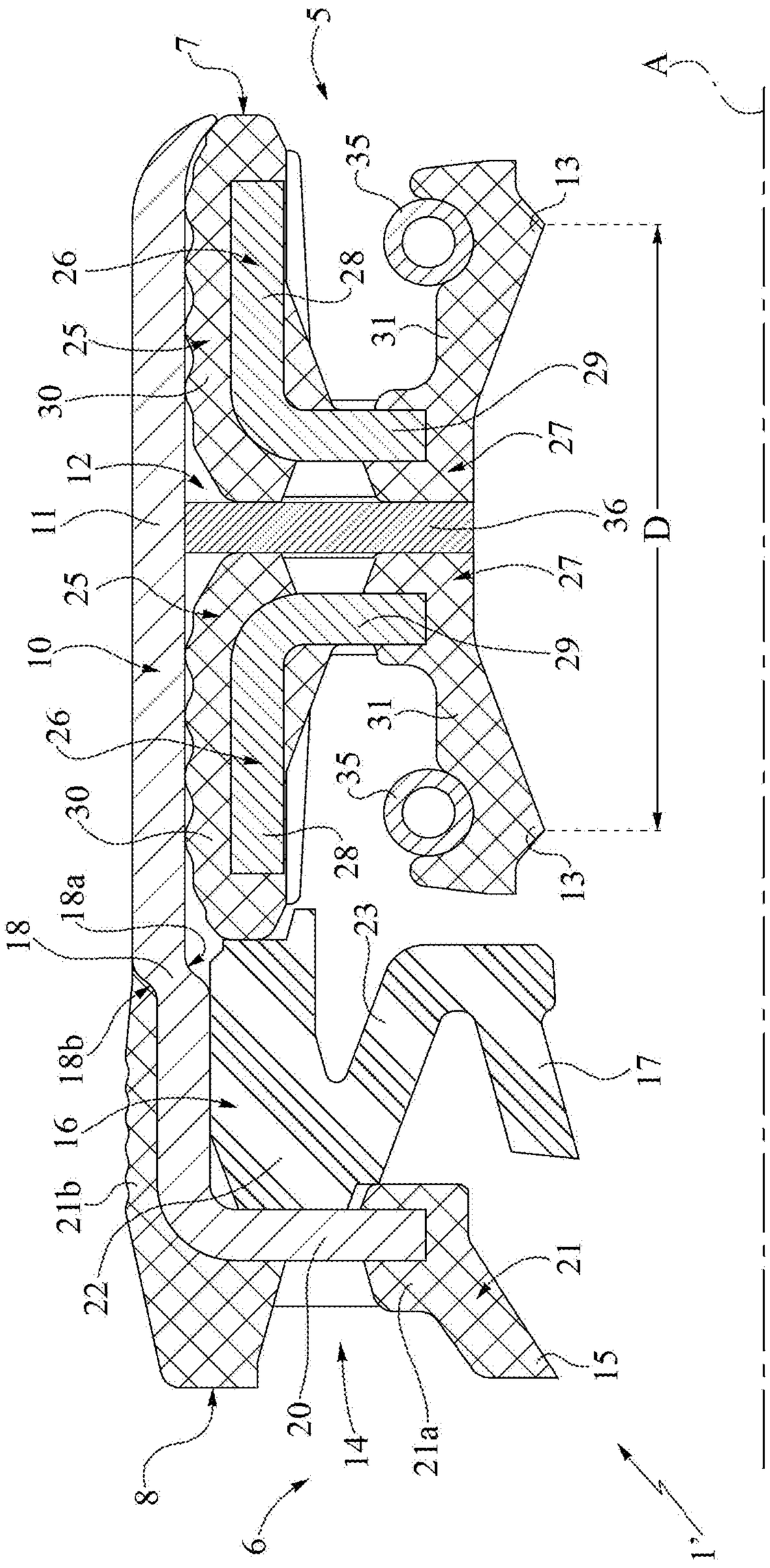
FIG. 3


A
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1'
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FIG. 4

GASKET

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under 35 U.S.C. § 119 to Italian Patent Application No. TO2015A000203, filed Apr. 7, 2015, the entirety of which is incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to a sealing gasket for sealing a compartment between a movable member with a roto-translatory motion and a fixed member, so as to prevent the passage of lubricant from a first ambient to a second ambient, arranged on opposite sides of said compartment, and to hinder the passage of external contaminants from the second ambient to the first ambient.

BACKGROUND OF THE INVENTION

They are known gaskets of the above type, suitable to be used in working vehicles, such as tractors or earth-moving machines, under extremely severe operating conditions, characterized for example by:

- intermittent operation of the motor, i.e. with continuous passages from a start condition to a stop condition and vice versa;
- continuous back and forth movements of the vehicles, with angular movements in opposite directions of the rotating members on which the aforesaid gaskets are applied;
- partial immersion of the vehicles in mud;
- adverse weather conditions; and
- relatively high circumferential speed of the rotating members on which the aforesaid gaskets are applied.

The gaskets of known type substantially comprise:

- a support ring made of a metallic material, having a annular axial fixing portion, adapted to be connected in use to the fixed member;
- a first ring of elastomeric material with a metallic inner core, radially more internal than the fixing portion of the support ring fixed to the fixing portion in a position adjacent to the first ambient and adapted to cooperate in use with the movable member to counter the passage of lubricant from the first ambient to the second ambient and the passage of external contaminants from the second ambient to the first ambient during the roto-translatory motion of the movable member;
- a second sealing ring made of elastomeric material, carried by the support ring in a position adjacent to the second ambient and adapted to cooperate in use with the movable member to counter the passage of external contaminants from the second ambient to the first sealing ring; and
- an annular wiper element, made of polyurethane or elastomeric material, axially interposed between the first and the second sealing ring and having an annular wiping lip adapted to cooperate in use with the movable member to counter the passage of external contaminants towards the first sealing ring.

The axial movement of the movable member in opposite directions requires the use, on the first sealing ring, of two barriers represented by two annular sealing lips, axially spaced from each other, in order to provide an adequate sealing against external contaminants. In fact, possible wear

areas on the outer surface of the movable member, such as incisions, grooves, etc., might become a receptacle for external contaminants which might pass, with the axial movement of the movable member, into the first ambient if only a single barrier were provided on the first sealing ring.

In order to be effective, the two sealing lips of the first sealing ring must necessarily be arranged at an axial distance greater than the maximum axial displacement allowed to the movable member during operation. In this way, in fact, any wear area located upstream of the two sealing lips before the axial movement of the movable member towards the first ambient might not reach the first ambient.

The described solutions, although being functionally effective in many applications, do not allow a large spacing between the two sealing lips of the first sealing ring, especially in the case of gaskets having reduced radial sections. In these cases, in fact, the first sealing ring cannot overhangingly support two sealing lips if they are spaced beyond a certain axial distance.

SUMMARY OF THE INVENTION

The object of the present invention is a sealing gasket which simply and economically allows solving the aforesaid problem connected with the gaskets of known type.

Said object is achieved by the present invention in that it relates to a sealing gasket as defined in claim **1**.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, two preferred embodiments are described in the following, purely by way of non-limiting examples and with reference to the accompanying drawings, in which:

FIG. **1** is an axial half-section of a gasket according to the present invention, mounted in use between a fixed and a movable member to seal the space between them;

FIG. **2** is a perspective view, on an enlarged scale, of a portion of the gasket of FIG. **1**;

FIG. **3** is an axial half-section, on an enlarged scale, of the gasket of FIG. **1**; and

FIG. **4** is a half-section similar to FIG. **3** and showing a different embodiment of the gasket according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. **1**, **1** indicates as a whole a self-supporting sealing gasket housed in the compartment **2** defined between an annular fixed member **3** having an axis A and a movable member **4**, coaxially mounted within the fixed member **3** and with a roto-translatory motion with respect to the axis A, for example a shaft controlling the steering wheels of a vehicle.

In particular, the movable member **4** rotates in use around the axis A and further has a sliding motion along the axis A inside the fixed member **3**.

The compartment **2** connects two ambients **5**, **6** arranged on axially opposite sides of the gasket **1** with reference to the axis A; in the shown case, the ambient **5** (to the right in FIG. **1**) contains lubricant, while the ambient **6** (to the left in FIG. **1**) directly communicates with the outside.

The gasket **1** is adapted to seal the compartment **2** to prevent the passage of lubricant from the ambient **5** to the ambient **6** and hinder the passage of external contaminants from the ambient **6** to the ambient **5**.

The gasket **1** has an annular configuration about the middle axis A and has a first and a second opposite axial end **7**, **8** in use respectively facing the ambients **5** and **6**.

With reference to FIGS. **1** to **3**, the gasket **1** comprises:

an outer support ring **10**, in particular of rigid material, having an annular fixing portion **11** adapted to be connected in use to the fixed member **3** and extending between the axial ends **7** and **8**;

first sealing means **12**, internally carried by the fixing portion **11** of the support ring **10** in a position adjacent to the axial end **7** and defining two annular sealing lips **13** axially spaced from each other by a predefined distance D and adapted to cooperate in use with the movable member **4** to counter the passage of lubricant from the ambient **5** to the ambient **6** and hinder the passage of external contaminants from the ambient **6** to the ambient **5** during the roto-translatory motion of the movable member **4**;

second sealing means **14**, carried by the support ring **10** in an axially interposed position between the sealing means **12** and the axial end **8** and defining at least one annular sealing lip **15**, axially spaced from the sealing lips **13** and adapted to cooperate in use with the movable member **4** to counter the passage of external contaminants from the ambient **6** to the inside of the compartment **2** and then to the ambient **5**; and

an annular wiper element **16**, preferably made of polyurethane or elastomeric material, axially interposed between the sealing means **12** and **14** and having an annular wiping lip **17**, adapted to cooperate in use with the movable member **4** to counter the passage of external contaminants towards the sealing lips **13**.

Preferably, the support ring **10** is made of metallic material; it is also possible that it is wholly or partially made of plastic material or includes plastic inserts.

In the example shown in FIGS. **1** to **3**, the fixing portion **11** of the support ring **10** extends essentially parallel to the axis A, i.e. it has a mainly axial development.

In the present description and in the claims, the term "axial" is used to indicate portions which extend parallel to the axis A of the gasket **1**, regardless of the fact that these portions may comprise shoulders or steps of reduced size, that do not substantially modify their axial development.

In the example shown, the fixing portion **11** of the support ring **10** has a rounded intermediate step **18** defining respective annular shoulders **18***a*, **18***b* facing the opposite axial ends **7**, **8** of the gasket **1**; the shoulder **18***b* is adapted to define an axial stop for the sealing means **14** as better explained in greater detail below.

The support ring **10** further comprises a radial annular portion **20** overhangingly extending towards decreasing diameters with respect to the axis A starting from one end of the fixing portion **11** adjacent to the axial end **8** of the gasket **1**; the radial portion **20** is also connected to the fixing portion **11** by means of a curved section.

The sealing means **14** comprise an annular elastomeric element **21** having an essentially radial portion **21***a*, fitted on the radial portion **20** of the support ring **10**, and an axial portion **21***b* covering a radially outer surface of the fixing portion **11**, between the axial end **8** and the shoulder **21***b*; in this way, in use, the axial portion **21***b* of the elastomeric ring **21** is interposed between the fixing portion **11** of the support ring **10** and the fixed member **3**, defining a static seal between them.

The sealing lip **15** overhangingly projects from a free end of the radial portion **21***a* of the elastomeric element **21**, in use facing the movable member **4**; the sealing lip **15** has a truncated-conical shape with a diameter decreasing towards the axial end **8** of the gasket **1**.

In particular, in the shown case, said axial end **8** is defined by the sealing lip **15** and by a section of the radial portion **21***a* of the elastomeric element **21**.

The wiper element **16** is axially sandwiched between the radial portion **20** of the support ring **10** and the sealing means **12**.

In particular, the axial half-section of the wiper element **16** is approximately S-shaped and comprises in succession towards decreasing diameters with respect to the axis A:

an annular axial portion **22** arranged in contact with a radially inner surface of the fixing portion **11** of the support ring **10**;

a truncated-conical intermediate portion **23**, extending from one end of the axial portion **22** adjacent to the radial portion **20** of the support ring **10** and having a diameter decreasing towards the sealing means **12**; and

the wiping lip **17** extending from the free end of the intermediate portion **23** towards the axial end **8** and having a truncated-conical shape with decreasing diameters towards the axial end **8**.

As shown in FIGS. **1** to **3**, the wiping lip **17** is axially interposed between the sealing lip **15** and the sealing lips **13**.

The axial portion **22** of the wiper element **16** is sandwiched between the radial portion **20** of the support ring **10** and the sealing means **12**.

Advantageously, the sealing means **12** comprise two distinct sealing rings **25**, axially arranged side by side and respectively carrying a relative sealing lip **13**.

In the example shown in FIGS. **1** to **3**, the sealing rings **25** are axially contiguous.

The sealing rings **25** are the same and their axial half-section is respectively C-shaped.

The sealing rings **25** are advantageously arranged with their respective concavities facing opposite sides. In the example shown in FIGS. **1** to **3**, the sealing ring **25** adjacent to the axial end **7** has the concavity turned towards this end, whereas the other sealing ring **25** has the concavity turned towards the wiper element **16** or, in an equivalent manner, towards the axial end **8**.

Each sealing lip **13** is made at a free end portion of the respective sealing ring **25** opposite to the one which in use is close to the other sealing ring **25**.

Each sealing ring **25** internally includes an annular stiffening element **26**, preferably made of metal material, externally covered by an elastomeric element **27** which is annular too.

In particular, each stiffening element **26** comprises an axial portion **28**, extending parallel and adjacent to the fixing portion **11** of the support ring **10**, and a radial portion **29** overhangingly projecting from the axial portion **28** towards decreasing diameters with respect to the axis A.

More precisely, the radial portions **29** of the stiffening elements **26** are arranged side by side and parallel, whereas the axial portions **28** overhangingly extend from the ends having a greater diameter of the radial portions **29** towards the opposite axial ends **7**, **8**.

The radial portion **29** of each stiffening element is connected to the relative axial portion **28** by means of a curved section.

Each elastomeric element **27** comprises:

a first axial portion **30** fitted on the axial portion **28** of the respective stiffening element **26** and arranged in contact with the radially inner surface of the fixing portion **11** of the support ring **10**;

a second axial portion **31** facing the axial portion **30** and provided with the relative sealing lip **13** on the opposite side to the one facing the axial portion **30**; and

a radial connection portion **32** between the axial portions **30** and **31**, fitted on the radial portion **29** of the respective stiffening element **26**.

The axial and radial portions **28**, **29** of each stiffening element **26** are respectively inserted in the axial and radial portions **30**, **32** of the respective elastomeric element **27**.

The axial portion **31** of each elastomeric element **27** axially overhangingly projects from the minimum diameter radial end of the respective stiffening element **26** and is pressed, in use, into the movable member **4** by a relative annular spring **35**.

In FIG. **4**, **1'** indicates as a whole a different embodiment of a gasket according to the present invention, suitable to be housed in the compartment **2** to prevent the passage of lubricant from the ambient **5** to the ambient **6** and to counter the passage of external contaminants from the ambient **6** to the ambient **5**; the gasket **1'** is described hereinafter only insofar as it differs from the gasket **1**, indicating with the same reference numbers parts identical or equivalent to parts already described.

In particular, the gasket **1'** differs from the gasket **1** essentially because it comprises a spacer ring **36** axially interposed between the radial portions **32** of the elastomeric elements **27** of the sealing rings **25** and contacting the radial portions **32** at their opposite axial surfaces.

More precisely, the spacer ring **36** is defined by a flat annular disc of axis A.

By varying the thickness of the spacer ring **36** it is possible to adapt the distance D between the sealing lips **13** to the one required to prevent external contaminants from the ambient **6** from entering the ambient **5** as a result of the axial movement of the movable member **4**.

The distance D between the sealing lips **13** is advantageously greater than the axial distance covered by the movable member **4** during each movement along the axis A and is independent from the radial thickness of the gasket **1**, **1'**. In this way, if the movable member **4** had, in its portion comprised between the sealing lip **13** closer to the axial end **8** and the axial end **8**, any wear areas, such as small recesses or grooves where external contaminants could gather, these could never overcome the sealing lip **13** adjacent to the ambient **5** and contaminate the lubricant therein, thanks to the axial movement of the movable member **4** towards the axial end **7**.

In use, any external contaminants from the ambient **6** should overcome in sequence the barriers represented by the lip **15** of the elastomeric element **21**, by the wiping lip **17** of the wiper element **16** and by the sealing lips **13** before reaching the ambient **5**.

This ensures a high number of working hours of the gaskets **1**, **1'** under severe conditions, namely on excavators or machines, usually operating for example on muddy terrain.

Thanks to the fact that the sealing lips **13** are integrally carried by distinct sealing rings **25**, it is possible to achieve distances D greater than those allowed by the gaskets of known type, even in solutions having a reduced radial thickness.

Furthermore, the proposed solution allows using the same sealing ring **25** for sealing both the ambient **5** (lubricant) and the ambient **6** (external contaminants), with savings in terms of number of components to manufacture and keep in stock.

Moreover, the possibility to insert a spacer ring between the sealing rings **25**, as in the case of the gasket **1'**, allows covering any distance D, regardless of the radial thickness of the used gasket.

Finally, it is clear that the gaskets **1**, **1'** here described and shown can be subject to modifications and variations without departing from the scope of protection defined by the appended claims.

What is claimed is:

1. A self-supporting gasket (**1**, **1'**) for sealing a compartment (**2**) between a fixed member (**3**) and a movable member (**4**), provided with roto-translatory motion with respect to a middle axis (A), so as to prevent the passage of lubricant from a first ambient environment (**5**) to a second ambient environment (**6**) arranged on opposite axial sides of said compartment (**2**), and to at least hinder the passage of external contaminants from said second ambient environment (**6**) to said first ambient environment (**5**);

said gasket (**1**, **1'**) having an annular configuration about said middle axis (A) and having opposite first and second axial ends (**7**, **8**), adapted to be arranged, in use, facing said first and second ambient environments (**5**, **6**), respectively;

said gasket (**1**, **1'**) comprising:

a support ring (**10**), made of rigid material, having an annular fixing portion (**11**) adapted to be connected, in use, to said fixed member (**3**) and extending between said first and second axial ends (**7**, **8**);

a first sealing arrangement (**12**) radially more internal than said fixing portion (**11**) of said support ring (**10**), carried by the fixing portion (**11**) in a position adjacent to said first axial end (**7**) and defining two first annular sealing lips (**13**) axially spaced from each another by a predetermined distance (D) and adapted to cooperate, in use, with said movable member (**4**) to counter the passage of lubricant from said first ambient environment (**5**) to said second ambient environment (**6**) and of external contaminants from said second ambient environment (**6**) to said first ambient environment (**5**) during the roto-translatory motion of the movable member (**4**) with respect to said middle axis (A);

a second sealing arrangement (**14**) carried by said support ring (**10**) in a position axially interposed between said first sealing arrangement (**12**) and said second axial end (**8**) and defining at least a second annular sealing lip (**15**) axially spaced from said first annular sealing lips (**13**) and adapted to cooperate, in use, with said movable member (**4**) to counter the passage of external contaminants towards said first annular sealing lips (**13**) during the roto-translatory motion of the movable member (**4**) with respect to said middle axis (A);

characterized in that said first sealing arrangement (**12**) comprises two first distinct sealing rings (**25**), axially arranged side by side and each respectively comprising integrally one of the first annular sealing lips (**13**); wherein each of two first distinct first sealing rings (**25**) are respectively C-shaped; and wherein said first sealing rings (**25**) each have respective concavities facing opposite sides.

2. The gasket according to claim **1**, wherein said first sealing rings (**25**) each have an identical shape.

3. The gasket according to claim **1**, wherein each first annular sealing lip (**13**) is respectively formed at a free end portion of one of said first sealing rings (**25**).

4. The gasket according to claim 1, wherein said first sealing rings (25) are axially contiguous.

5. The gasket according to claim 1, further comprising a spacer ring (36) axially interposed between said first sealing rings (25) and contacting the first sealing rings (25) at opposite axial surfaces.

6. The gasket according to claim 1, wherein each said first sealing ring (25) internally comprises an annular stiffening element (26) externally covered at least partially by an elastomeric element (27) and having an annular shape.

7. The gasket according to claim 6, wherein the elastomeric element (27) of each first sealing ring (25) comprises a first axial portion (30) arranged in contact with said fixing portion (11) of said support ring (10), a second axial portion (31) substantially parallel to and facing the first axial portion (30) and each respectively provided with one of said first annular sealing lips (13), and a radial connection portion (32) between said first and second axial portions (30, 31).

8. The gasket according to claim 7, wherein the stiffening element (26) of each first sealing ring (25) comprises an axial portion (28), inserted in said first axial portion (30) of said elastomeric element (27), and a radial portion (29) inserted in said radial connection portion (32) of said elastomeric element (27); and wherein said second axial portion (31) of said elastomeric element (27) axially projects from an inner diameter radial end of said stiffening element (26).

9. The gasket according to claim 1, wherein said fixing portion (11) essentially extends in parallel with respect to said middle axis (A).

10. The gasket according to claim 1, further comprising an annular wiper element (16) axially interposed between said first and second sealing arrangement (12, 14) and having an annular wiping lip (17) adapted to cooperate, in use, with said movable member (4) to counter the passage of external contaminants towards said first annular sealing lips (13).

11. The gasket according to claim 10, wherein said support ring (10) comprises a radial portion (20) adjacent to said second axial end (8) and extending radially inward from said fixing portion (11) with respect to said middle axis (A); wherein said second sealing arrangement (14) comprises a first and a second annular elastomeric element (21) fitted on said radial portion (20) of said support ring (10); and wherein said wiper element (16) is axially sandwiched between said radial portion (20) of said support ring (10) and said first sealing arrangement (12).

* * * * *